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COMPLETE SPECIFICATION

Improvements in piston rings of alloy cast iron

I, TAGE DEBUSMANN MADSEN, a Swedish subject, of 20 Stampgaten, Goteburg, Sweden, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

Piston rings for combustion engines, compressors, pumps and the like, are subject under working conditions in a cylinder to wear not only at the surface in contact with the cylinder but also at their surfaces engaging the piston grooves. These surfaces are at the same time exposed to considerable static and dynamic bending loads. When as often occurs, there is an unsatisfactory lubricating state between the peripheral face of the ring and the cylinder wall, it is mainly a matter of a friction wearing. This disadvantage is increased by corrosion, e.g. in combustion engines by chemical attacking compounds generated by combustion, and also by moisture which is formed on the cylinder wall, by the presence of chemical attacking material in the scavenging air or that used for combustion, or by a content of similar attacking matter in the lubricating oil and so on.

Cast iron is generally used when making piston rings, and one is especially strict in one's demands concerning the structure, hardness and elastic qualities of this cast iron. The material of the piston rings is, as a rule, adapted to the cylinder material so that the best possible sliding or wearing qualities may be obtained.

As a rule, the material of the piston rings is unalloyed. However, it is also known to use alloy piston rings when stress is laid upon obtaining a preferred structure, hardness and good strength qualities. Further, by using an alloy one aims at attaining an improvement of the strain of the ring under the influence of the working temperature. Finally, it is also known to alloy the ring material in order to increase the corrosion resistance.

I have carried out investigation and experiments in connection with the production of piston rings made of cast iron alloy using cast iron containing a usual amount of carbon within the range of 2.50%—3.90%, preferably with a smaller percentage of silicon in the range of 1.2%—1.7%. The content of carbon and silicon however, depends upon the casting method employed and also upon the cross-section of the rings and the stresses to which the rings will be subjected.

According to the present invention piston rings of cast iron alloy are characterised by the fact that the cast iron is alloyed with vanadium, titanium and copper in the following proportions:—

V = 0.15—0.45% of the alloy.
Ti = 1/6—1/2 of the amount of V.
Cu = 3—5 times the amount of V.
C = 2.50—3.90% of the alloy.

Preferably, the alloy also contains phosphorus within the range 0.15—0.60%. If silicon is included in the alloy the range of proportions lies between 0.80—3.0% of the alloy.

The best results are obtained when the piston ring has a chromed finish, so that it not only possesses the quality of resistance to stress under working temperatures, but will glide readily in the cylinder or cylinder liner.

The following three examples illustrate typical analyses of alloys according to the invention.

C	Si	Mn	P	S	V	Ti	Cu	Fe
3.27	1.67	0.88	0.17	0.07	0.15	0.07	0.72	Rest
3.31	1.38	0.83	0.24	0.08	0.26	0.09	0.96	„
3.24	1.31	0.92	0.30	0.06	0.35	0.15	1.23	„

By this method, piston rings are obtained not only with a low wearing characteristic but also with increased strength values and provided with a considerably high vibration resistance and a capability of withstanding high ring strain in use.

In my concurrent application for Letters Patent No. 14419/53 (Serial No. 735,965) there is claimed a cast-iron alloy for cylinder liners of piston machines which is characterised in that the cast iron is alloyed with vanadium, titanium and copper in the following proportions:—

V = 0.15—0.50% of the alloy.
Ti = 1/6—3/4 of the amount of V.
Cu = 2—6 times of the amount of V.
C = 2.50—3.60% of the alloy.

What I claim is:—

1. Piston rings of cast iron alloy for piston machines, especially for combustion engines, compressors and pumps, characterised by the fact that the cast iron is alloyed with vanadium, titanium and copper in the following proportions:—

V = 0.15—0.45% of the alloy.
Ti = 1/6—1/2 of the amount of V.
Cu = 3—5 times the amount of V.
C = 2.50—3.90% of the alloy.

2. Piston ring according to Claim 1, characterised by the fact that the alloy contains 0.15—0.60% phosphorus.

3. Piston ring according to Claims 1 and 2, characterised by the fact that the ring has a chromed finish face.

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